which to within the syphon is closed by shutting the valve, or when open the water may be admitted from said reservoir, and retained within until the syphon is filled; the outlet being closed by a gate or sliding valve fitted to the end of the longer leg, which remains shut until every thing is ready for operation.

The manner of operation will be more readily explained by reference to the annexed sketch.

Let the dotted lines W, W, represent the surface, below which S and L receive and discharge the water.

The stop gate G being closed, and the valve 2 open, the syphon is filled by pouring water in at R. When full the valve 2 is placed on its seat, and covered by the water left in R, to prevent the admission of air. G being raised, the water ascends through S, and descends L to the outlet. If any considerable diminution is observed in the discharge, we may conclude it is occasioned by an accumulation of air within the syphon.

By closing G the valve 1 will likewise be closed, but before this can be effected, if the stoppage at G be sudden, a concussion is produced by the continued action of the water, which forces itself with any air which may be within, through the valve 2, leaving the syphon free to act with renewed energy. The valve 1, if made in the form of a double cone (as here represented,) and properly proportioned, gives, when opened to the extent permitted by its tail piece, an undiminished water way, without *increasing the internal area* of this section of the syphon. This I believe is considered desirable by philosophers, but in many cases a contraction of the water way is not so important but that a plain valve of ordinary construction might be substituted. For most practical purposes the syphon is made on a small scale, and the outlet may more conveniently be closed by a stop cock than with a sliding valve.

The entrance and discharge of the water might be considerably facilitated by adjuncts of proper construction; and for a syphon on a large scale, may probably be applied with considerable advantage.

FRANKLIN INSTITUTE.

Explosions of Steam Boilers.

(No. XXIX.)

New York, July 30, 1832.

TO THE COMMITTEE ON EXPLOSIONS.

GENTLEMEN,—Presuming that some account of the recent disaster on board the steam-boat Ohio, would be acceptable to you, the following is respectfully submitted. As I believe this explosion was the natural consequence of a defective construction or arrangement

of the internal flues, and as the same plan is adopted in nearly all our new boats, and in a majority of all others belonging to this city, it is of immense importance that the true character of this "plan" be ascertained and made known.

Very respectfully,
THOS. EWBANK.

Explosion of one of the boilers of the Steam-boat Ohio.

An explosion occurred in one of the boilers of this boat on Friday evening, July 6, when near Sing Sing, on her passage hence to Albany, by which five more of our citizens have perished. This is the fifth disaster of the kind reported in the course of the present year, and every one of which, it is believed, accompanied with loss of life.

I precede my remarks upon this explosion by a letter from the captain of the boat to the editors of the daily papers, and by the testimony given before the coroner's jury.

"Steam-boat Ohio, July 7, 1832.

"GENTLEMEN,—On our passage up yesterday afternoon, an accident occurred on board of the boat under my command which is much to be deplored. A short distance from Sing Sing, while under a common head of steam, and plenty of water in the boilers, a rent occurred in the steam chimney of the starboard boiler. The steam and water rushed out of the boiler, and, melancholy to relate, scalded three of the passengers. Every attention was shown to the sufferers, who died before morning. Their names were John Connor, of Albany, William Farnham, of Greenbush, and Eli Bower, of Poughkeepsie; also two of the crew, Samuel McMullen and Rob. Steward, are missing, who, it is presumed, jumped overboard.—These are the only persons missing, as far as I can learn. There were upwards of three hundred persons on board, part of which went to Newburgh in the Experiment, and the remainder returned with the boat to New York. As there was no other boat out last evening there was no occasion for an extra head of steam. The injury to the steam chimney can be repaired in a short time, and she can take her place, and leave here on Monday afternoon for Albany at 5 o'clock.

MARTIN BARTHOLOMEW, Master."

"Captain Bartholomew, commander of the boat, testified that he left this city last evening, for Albany; when about thirty-six miles from this city, he heard an explosion which he immediately ascertained had been caused by the bursting of the steam chimney; this was about fifteen minutes after 8 o'clock, last evening; in consequence of the bursting of the chimney, the water was forced back through the return flues and out the door of the furnace.

The names of the deceased persons now on board, are John Connor, of Albany, aged 30 years; Wm. Farnum, of Greenbush, aged about 26 years, and Eli Brower, cloth manufacturer, of Poughkeepsie, aged 40 years. The first two named were lying on the skylight

which covers the cabin, exactly opposite to that part of the furnace through which the water rushed. Mr. Brower was standing near the same place. The boat was under a moderate press of steam, about fourteen inches; the boat often carries eighteen inches, and sometimes twenty, with perfect safety; they sometimes proceed with less steam than fourteen inches, when no more can be had; there was a sufficiency of water in the boiler, as one of the men who examined can testify; the chimney was iron, and was placed there new last season; the chimney is always expected to last as long as the boiler, which is about five years: the boiler was overhauled a short time since.

Two other persons besides those now on board dead, are lost; they were hands on board; their names were Samuel M. Mullen and Robert Stewart; they leaped overboard and were drowned before efficient aid could be rendered to them.

Peter Mathews, a fireman on board, testified that there was fifteen inches of steam on—he had just tried the quantity a minute before the accident occurred; the boat frequently carries seventeen inches, a quantity which is perfectly safe; does not recollect to have seen her carry twenty inches; has been in her about two years; the chimney was considered in good order.

Nathaniel Cornell, a hand on board, examined the water about five minutes before the accident occurred; there was then enough in the boiler; however, added some more, so that the accident could not have been caused by any insufficiency of water in the boiler; witness examined the chimney about two weeks since, it was then in good order.

Marcill Manning examined the chimney about a week since, it was then in good order; a patch was placed on one side of it about seven days before; it was not at the part repaired that the chimney burst, but much lower down, and on an opposite side.

Alexander Homestrum, the engineer, corroborated the testimony of the other witnesses as to the state of the steam and the water.

In addition to this testimony, the jury examined the bodies on board, and also the state of the chimney and boiler, and returned a verdict that the deceased persons had been scalded to death in consequence of the accidental bursting of the steam chimney on board the Ohio."

It is to be regretted that when disasters of this kind occur, inquiry is seldom instituted with a determination to ascertain the cause *any further than as it may implicate the captain, or the engineer and his attendants*. When no blame can be attached to them, the explosion seems to be looked upon as a mystery too dark to be scrutinized, and little or no effort is made to explore it. The rupture is repaired, and the boat runs again as before. Public excitement is transient, and the occurrence is soon forgotten except by the relatives and friends of the sufferers.

So long as this continues to be the case, there is no security that hundreds more of our citizens will not be hurried out of existence by steam-boat explosions. These awful occurrences cannot be

prevented except by removing the causes of them. And how can they be removed, while these remain unknown?

That the primary cause of the present explosion was not known to the captain, may be inferred from the latter part of his letter, where he says "the steam chimney can be repaired, and the boat take her place on Monday;" and that it remains equally unknown to the owners and others concerned, would appear from their merely repairing the ruptured flue, (which they are doing,) without altering in the least its internal arrangement.

By referring to page 131, vol. ii. of the Journal of the Institute, the committee will find the origin of "steam chimnies;" but as no description sufficiently definite is there given of one, I have enclosed a sketch of that of the Ohio.*

Fig. 1.

the boiler, (see fig. 2.) The dark parts in fig. 1 are spaces left between the sides of the boiler and the flues, and between each of the flues, and are occupied by water. The arrows show the direction of the flame.

Fig. 1, is a plan of the flues and bottom of the boiler. A is the front end, at which the fuel is applied. The flame passes under the bottom to the other end, where it is received into the box or case B, which is open at its under side. The horizontal flues a, a, a, a, a, are connected with the case B; and their other ends lead into C, the main flue, which passes vertically through

Fig. 2.

Fig. 2, is a longitudinal section of the boiler. C, is the ruptured flue, its upper part enclosed in another tube E, E, called a "steam chimney," attached to the top of the boiler, and forming part of it. A space is left all round C of 6 $\frac{1}{4}$ inches. E, E, and C, are united at D, D, and made steam tight.

The chimney proper is merely slipped on C at D, D, and held to its place by braces. At the upper

* In the course of conversation with an intelligent engineer who assisted me in obtaining information in relation to this explosion, he remarked that the rapid corrosion of the interior of iron boilers, might, in many cases, be attributed to the copper in the composition of the air pump, valves, feed pump, and pipes, &c. the water passing through them into the boiler having a *galvanic influence on the iron of the boiler*. In one case he observed that the part of an internal flue immediately opposite the mouth of a feeding pipe, and about four inches from it, was entirely eaten away, leaving a hole in the flue nine inches in diameter.

end of E is inserted the steam pipe S, it projects three inches, (or about half way,) through E, as represented. It is eleven inches in diameter. The horizontal flues, five in number, are twenty inches in diameter. The vertical flue forty-two inches. From its junction with the horizontal flues, (only one of which is seen in this figure,) to its upper end at D, D, is eleven feet. The water line at W, W, is about ten inches above the horizontal flues, and the remainder of C, being ten feet of its length, is always uncovered by water. The rent took place at R, from fifteen to twenty inches above the water line.

The line of fracture does not deviate more than six inches from a horizontal direction. It is partly along a row of rivets, but chiefly through the centre of the sheets. In one sheet the fracture exhibits the metal from one-fourth of an inch (its original thickness,) to one-eighth, and less than one-sixteenth.

The boiler is eighteen feet long, eleven feet wide, and six and a half feet deep, (see fig. 3,) its ends are flat. It is made of one-fourth inch wrought iron. Y, shows the form of the lower end of the collapsed flue; the circular part contained in dotted lines shows the original form of the flue, the irregular full lines show the form after the collapse. Fig. 4 represents it previous to its being taken out of the boiler; from the rent to the top of the collapse is six feet.

It will be perceived that the rent took place in that part of the main flue unprotected by water, and not in the steam chimney proper. This part of the flue is *always* exposed to the flame or heated air, and *never* covered by water.

Engineers consider it necessary to keep internal flues as well as those portions of the sides of boilers which are exposed to the fire, covered by water, as the only means of preventing them from rending; but in using steam chimneys, a method the *very reverse* is adopted. By them part of the flue above the water, is *necessarily* exposed, and this part embraces nearly the *whole* of the main internal flue, in which is accumulated all the heat and flame from the furnace that escapes through the horizontal flues.

In the Ohio, the part thus exposed is ten feet long and three and a

half feet diameter, the whole of which is always uncovered by water, except what may be occasionally thrown up against it by ebullition.

The circumstance of this flue being in a perpendicular position can impart no additional security from the action of the fire, but rather the contrary, since the whole of its circumference is exposed to its influence. The only difference in its favour is that the greatest portion of heat from the furnace is probably taken up by the bottom of the boiler and the horizontal flues before entering it; and this is the supposition of those who advocate the use of steam chimnies. The heat, they further say, is "*exhausted*" before entering the vertical flue, and that without regard to the nature of the fuel used.

But if the heat were *exhausted* before entering the vertical flue, the steam chimney would be useless, as its design is to impart the extra heat of the fire chimney to the steam.

This heat is, however, far from being exhausted. The working cylinders of the Ohio are nearly forty feet distant from the steam chimnies, consequently the steam pipes are about the same length; and yet the packing of the pistons, and the hempen covering of the steam pipes, have frequently been charred.

The temperature of that portion of the horizontal flues near to where they unite with the vertical one, will be much the same as the lower part of the latter. If there be any difference, the vertical flue is probably the hottest, because the heat from all the others is there received by it, and the direction of the draft is suddenly changed at the same place: hence, if part of the horizontal flues are in danger of collapse when uncovered by water, the lower part, at least, of the vertical flue is equally so, and from the same cause.

But the appearance of the ruptured flue is a sufficient proof that the heat is not exhausted before entering it. It is fairly burnt out. In some places not even one-sixth of its thickness is left. The greater part of this flue was new about eighteen months ago, but the part rent has been in use a little more than two years.

When it is considered that the part rent was constantly liable to be made *red hot*, and probably was frequently so, we need not wonder that it collapsed under a pressure of fifteen pounds to the square inch. The greater wonder is, that it withstood it so long.

The same cause also accounts for the rapid destruction of its material. Indeed these flues are all rapidly worn out at the same place, and this is the testimony of an experienced manufacturer of steam engines. It is corroborated also by that of an intelligent engineer, who informed me lately that one of our largest and most splendid boats, had a new vertical flue last season, and yet a portion of it had to be replaced near the water line a few weeks ago, being no longer safe.

There is another circumstance attending the use of steam chimnies which still further promotes the destruction of the flue in question, viz. the large quantity of mud and other matters that float on the water is drawn against this flue (where it hardens and forms a crust)

by the current of the steam in rushing up into the steam pipe at every stroke of the piston.

Fusible plates and valves have been designed to prevent the temperature of the steam from exceeding that of the water on which it reposes, but these devices are totally inapplicable to steam chimnies, since the very evil they are designed to prevent, is considered an advantage in the use of the latter.

The advantage of steam chimnies, it is said, is that "they rarify and still further expand the steam after it is generated;" but its expansive force cannot thereby be increased above that in the other parts of the boiler; for steam of different elastic power cannot exist in the same vessel at the same time. And whether they are of any advantage by depriving the steam of a portion of its moisture, previous to its entering the cylinder is at least doubtful, since it is one of its constituent principles, by depriving it of which, its density is proportionably diminished, and upon the density and temperature depend the expansive force of the steam.

The theoretical question of the effect of heating steam, after it is produced, in contact with the water which produced it, requires further elucidation. And after this should be determined we must consider the effect to be derived from transmitting this rarified steam through the pipes to the cylinder. But let us admit for steam chimnies all the advantages which have been claimed for them. Let us admit that their use economises heat which would otherwise be lost or less perfectly applied, and then let us answer the question, can these advantages make up for the increased dangers of explosions? can a paltry consideration of doubtful economy justify the exposure of human life incident to the use of a *heated flue uncovered by water*? The answer is plain, and the public are interested in making it heard.

THOS. EWBANK.

AMERICAN PATENTS.

LIST OF AMERICAN PATENTS WHICH ISSUED IN APRIL, 1832.

With Remarks and Exemplifications, by the Editor.

1. For a machine for *Planing Boards, Cutting Tenons*, reducing marble, and other hard substances, and for grinding and polishing the same; Moses Lancaster, Northern Liberties, Philadelphia county, April 5.

(See specification.)

2. For a machine for *Hulling Clover, Buckwheat and Bar-*